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CALVERT CLIFFS  
NUCLEAR POWER PLANT

May 27, 2010

U.S. Nuclear Regulatory Commission  
Washington, DC 20555

**ATTENTION:** Document Control Desk

**SUBJECT:** Calvert Cliffs Nuclear Power Plant  
Unit No. 2; Docket No. 50-318; License No. DPR 69  
Licensee Event Report 2010-001, Revision 01  
Reactor Trip Due to Failure of Protective Relay Circuitry

The attached supplemental report is being sent to you as required by 10 CFR 50.73. Should you have questions regarding this report, please contact Mr. Douglas E. Lauver at (410) 495-5219.

Very truly yours,

Thomas E. Trepanier  
Plant General Manager

TET/CAN/bjd

Attachment: As stated

cc: D. V. Pickett, NRC  
S. J. Collins, NRC

Resident Inspector, NRC  
S. Gray, DNR

JE22  
NLR

## LICENSEE EVENT REPORT (LER)

(See reverse for required number of  
digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

## 1. FACILITY NAME

Calvert Cliffs Nuclear Power Plant, Unit 2

## 2. DOCKET NUMBER

05000 318

## 3. PAGE

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## 4. TITLE

Reactor Trip Due to Failure of Protective Relay Circuitry

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED																																					
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10. POWER LEVEL																																														
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## 12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME

C. A. Neyman, Senior Engineering Analyst

TELEPHONE NUMBER (Include Area Code)

410-495-3507

## 13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
X	EA	64	W120	Y	X	EK	DG	F010	Y

## 14. SUPPLEMENTAL REPORT EXPECTED

☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE)☒ NO

## 15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

## ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On February 18, 2010, at 8:24 a.m., Unit 2 experienced an automatic reactor trip from 99.5 percent power. The Unit 2 Reactor Coolant Pumps (RCPs) lost power and the Reactor Protective System actuated on Reactor Coolant System low flow. The RCPs lost power due to a loss of Service Transformer P-13000-2 and the 500 kV Switchyard Red Bus being deenergized, deenergizing the 22 13 kV RCP Bus. The loss of P-13000-2 resulted in a loss of the normal power supply to 24 4 kV bus. This caused the 2B Emergency Diesel Generator (EDG) to start. Shortly after receiving a start signal, the 2B EDG tripped due to a low lube oil pressure trip.

The event was initiated when the Unit 1 12B RCP tripped due to an electrical fault in relay protective circuitry. The ground fault was not isolated close to the source due to a failed ground protection relay in breaker 252-2202, the feeder breaker from Service Transformer P-13000-2 to the Unit 1 RCP buses. This event is being reported pursuant to 10 CFR 50.73(a)(2)(iv)(A) due to Reactor Protective System actuation and automatic start of the 2B EDG, 10 CFR 50.73(a)(2)(i)(B) due to the inoperable condition of the 2B EDG and 10 CFR 50.73(a)(2)(v)(D) for those periods when two EDGs were out-of-service.

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## I. DESCRIPTION OF EVENT

### A. PRE-EVENT PLANT CONDITIONS

Unit 2 was operating at 99.5 percent of rated thermal power on February 18, 2010, prior to the subject event.

### B. EVENT

On February 18, 2010, at 8:24 a.m., Calvert Cliffs Nuclear Power Plant Unit 1 experienced an automatic reactor trip due to a ground fault in the electrical distribution system. Details of that event were submitted in a separate Licensee Event Report (LER 317/2010-001). The ground fault was not isolated close to the source due to the failure of 2RY251G/B22-2, the ground fault protection relay in breaker 252-2202, the feeder breaker from Service Transformer P-13000-2 to the Unit 1 Reactor Coolant Pump (RCP) buses. This resulted in Service Transformer P-13000-2 and the Switchyard Red Bus being deenergized, deenergizing the 22 13 kV RCP Bus. The Unit 2 RCPs lost power and the Reactor Protective System actuated on Reactor Coolant System low flow.

During isolation of Service Transformer P-13000-2, two circuit breakers failed to open. The breakers are 252-2201, 13 kV Unit 2 RCP Buses Normal Feed, and 152-2501, 4 kV Bus 25 Normal Feed. The failure of the breakers did not prevent the isolation of Service Transformer P-13000-2 nor did this impact response of any other equipment.

The associated loss of non-safety-related 4 kV buses 22, 23, 25, and 26 resulted in loss of main feedwater to the steam generators and a loss of circulating water pumps. A turbine-driven auxiliary feedwater pump and atmospheric dump valves were used for heat removal. Turbine bypass valves were available for approximately 18 minutes before main steam isolation valves were shut, but were not used due to the loss of circulating water pumps.

All control element assemblies fully inserted as expected. Following the reactor trip, the main turbine automatically tripped. Containment atmosphere parameters were unaffected by the trip. Radiation levels were not affected by the trip.

The loss of P-13000-2 resulted in a loss of the normal power supply to 24 4 kV bus. This caused the 2B Emergency Diesel Generator (EDG) to start. Shortly after receiving a start signal, the 2B EDG tripped due to a low lube oil pressure trip.

The loss of 24 4 kV Bus also resulted in 120 volt instrument bus 2Y10 being deenergized. This resulted in the loss of letdown flow from the Chemical and Volume Control System and a loss of remote control of the atmospheric dump valves. Bus 2Y10 was reenergized 10 minutes after the reactor trip using the cross-tie with 120 volt instrument bus 2Y09.

Following the reactor trip, the unit transitioned into Mode 5 for an unscheduled outage.

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**C. INOPERABLE STRUCTURES, COMPONENTS, OR SYSTEMS THAT CONTRIBUTED TO THE EVENT**

The following components were inoperable or failed at the time of the event:

- 2B EDG
- Breaker 252-2201
- Relay 2RY251G/B22-2
- Breaker 152-2501

**D. DATES AND APPROXIMATE TIMES OF MAJOR OCCURRENCES:**

The reactor trip occurred on February 18, 2010 at 8:24 a.m. Operators implemented Emergency Operating Procedure (EOP)-0, Post-Trip Immediate Actions, and performed post-trip immediate actions.

Operators implemented EOP-2, Loss of Offsite Power/Loss of Forced Circulation, 24 minutes after the reactor trip to perform post-trip recovery actions for a loss of offsite power and a loss of forced circulation. Operators reenergized 24 4 kV bus via the bus alternate feed 33 minutes after the reactor trip. Letdown flow was restored 37 minutes after the reactor trip.

Power was restored to non-safety-related 4 kV Buses 25 and 26, 4 hours and 56 minutes after the reactor trip.

Operators transitioned from EOP-2 to Operating Procedure-5, Plant Shutdown from Hot Standby to Cold Shutdown, 2 hours and 54 minutes after the reactor trip.

The 2B EDG was discovered to be inoperable due to tripping on a low lube oil pressure trip on February 18, 2010 at 8:24 a.m. The 2B EDG was returned to operable status on February 20, 2010 at 10:31 p.m.

Unit 2 was paralleled to the grid on February 28, 2010 at 00:18 a.m. The unit reached full reactor power on March 2, 2010 at 3:30 a.m.

**E. OTHER SYSTEMS OR SECONDARY FUNCTIONS AFFECTED**

Water hammer was noted in condensate system following the reactor trip. Walkdown results revealed no damage to systems, structures, and components.

Main Steam to 22 Moisture Separator Reheater Second Stage Tube Bundle Control Valve, 2CV-4019, failed to indicate closed initially following the turbine trip. Operators manually isolated 2CV-4019.

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#### F. METHOD OF DISCOVERY

The event was self-revealing.

#### G. SAFETY SYSTEM RESPONSES

The Reactor Protective System operated as required. The 2B EDG did not respond as required. However, the 2A EDG was operable and available to perform the required safety functions of the Emergency AC Power Supply System.

#### II. CAUSE OF EVENT:

The event is documented in station condition report numbers CR-2010-001388 and CR-2010-001340. Breaker 252-2202 failed to open due to a problem with its ground fault relay. The relay's magnetizing coil had shorted out the majority of the windings and would not allow the relay's induction disc to spin. Possible failure modes for the relay are:

- Aging degradation.
- A high amount of current during the event.
- The windings may have shorted following its calibration and testing in 2008.

The practice of normal system alignment with the breakers closed feeding alternate RCP busses from breakers 252-2202 and 252-1202, the feeder breaker from Service Transformer P-13000-1 to the Unit 2 RCP buses, contributed to the unit trip.

Breaker 252-2201 failed to open due to a failure of the trip coil. The cause of the failure was characterized as infant mortality.

Breaker 152-2501 failed to open due to a failure of the trip coil. The cause of the failure was an unspecified human performance error which was not detected due to inadequate post-maintenance testing following work in November 2008.

Two issues contributed to the failure of the 2B EDG.

1. The time delay circuits did not work as designed. Instead of providing an additional 15 second delay after the engine achieves 810 rpm, the T3A time delay relay enabled the trips after only 9.2 seconds. This shortened time delay enabled the low oil pressure trip before the engine was able to develop sufficient pressure at the low lube oil pressure switches to clear the trip condition. The premature operation of the time delay relay was attributed to pneumatic leakage caused by loose screws.
2. The low lube oil pressure switch reset was delayed by several seconds due to thick, viscous oil in the lube oil tubing. The thicker oil resulted in an additional time delay for oil pressure to travel through the lube oil pressure sensing line and reset the low lube oil

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pressure switches by several seconds. Lube oil in the sensing lines may have thickened over a period of years due to oxidation.

Should the causes or corrective actions change, a supplemental LER will be submitted.

**III. ANALYSIS OF THE EVENT:**

This event resulted in valid actuations of the Reactor Protective System and the 2B EDG. The actuations were not part of a pre-planned sequence during testing or reactor operation. Therefore, this event is reportable in accordance with 10 CFR 50.73(a)(2)(iv)(A). With one EDG inoperable, the Technical Specification Limiting Condition for Operation 3.8.1.B.5 required action is to restore the EDG to operable status within a 14 day completion time. If this required action cannot be met, Technical Specification Limiting Condition for Operation 3.8.1.J requires the plant to be placed in Mode 3 within 6 hours and in Mode 5 within 36 hours. Additionally, other EDGs were also inoperable at different times during the period when the 2B EDG was inoperable. This would have required the entry into Technical Specifications Limiting Condition for Operation 3.8.1.I and 3.8.1.J. Therefore, this event is reportable in accordance with 10 CFR 50.73(a)(2)(i)(B). The periods when both EDGs were out of service are also reportable in accordance with 10 CFR 50.73(a)(2)(v)(D), as the condition could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident.

Immediate notification of this event (Event Number 45709) was made on February 18, 2010 at 11:47 a.m. in accordance with 10 CFR 50.72(b)(2)(iv)(B) and 10 CFR 50.72(b)(3)(iv)(A).

The Nuclear Regulatory Commission (NRC) Performance Indicator for Unplanned Scrams per 7,000 Critical Hours increased to 0.8 and remains green. The NRC Performance Indicator for Unplanned Scrams with complications increased to 1 and remains green. The NRC Performance Indicator for Safety System Functional Failures will increase to 1 and remain green. The NRC Mitigating System Performance Index for the Emergency AC Power System remains green. No other performance indicators were impacted.

There were no actual nuclear safety consequences incurred from this event. An estimated conditional core damage probability of 9.8E-06 and an estimated conditional large early release probability of less than 9.8E-07 were calculated for this event.

**IV. CORRECTIVE ACTIONS:**

**A. ACTION TAKEN TO RETURN AFFECTED SYSTEMS TO PRE-EVENT NORMAL STATUS:**

Following the completion of the forced outage, Unit 2 was restarted and paralleled to the grid on February 28, 2010. Full reactor power was reached on March 2, 2010.

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**B. ACTION TAKEN OR PLANNED TO PREVENT RECURRENCE**

The protective relay was replaced on breaker 252-2202 and proper operation was verified. The T3A on the 2B EDG relay was replaced. The 2B EDG lube oil pressure sensing lines were drained and refilled. Trip coils were replaced in breakers 252-2201 and 152-2501.

Actions planned to prevent recurrence include:

1. The relay calibration procedure will be revised to perform a final as-left pickup verification to ensure a relay is not damaged during maintenance.
2. Operations post-maintenance test requirements will be revised for circuit breakers after work scope greater than preventive maintenance is completed.
3. Maintenance practices will be reviewed to ensure adequate flushing, filling, and venting of oil sensing lines in critical applications.
4. Revised system alignment with breakers 252-1202 and 252-2202 to reflect a normally open configuration. Operating procedures, supporting documentation, and design analysis will be changed.

**V. ADDITIONAL INFORMATION**

**A. FAILED COMPONENTS**

1. Breaker 252-2202 ground fault relay 2RY251G/B22-2 was manufactured by Westinghouse (Manufacturer Identification Number W120).
2. Breaker 252-2201 was manufactured by Powell. (Manufacturer Identification Number P312).
3. Breaker 152-2501 was manufactured by General Electric. (Manufacturer Identification Number G080).
4. The T3A relay was manufactured by Agastat (Manufacturer Identification Number A109).
5. The 2B EDG was manufactured by Fairbanks Morse (Manufacturer Identification Number F010).

**B. PREVIOUS LERs ON SIMILAR EVENTS**

A review of Calvert Cliffs' events over the past several years was performed. No previous occurrences were identified involving a reactor trip due to a partial loss of offsite power caused by failure of protective relay circuitry.

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### FAILURE CONTINUATION

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